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REPORTS.

REPORT OF COMMITTEE ON STANDARD MICROMETER.

[ABSTRACT.]

To the American Society of Microscopists:

Your Committee appointed to "prepare rules for the control of the Standard Micrometer, 'Centimeter Scale A, 1882,' and to have copies made and authenticated," would respectfully report that they have prepared the rules for the safe custody of the Standard, which rules have been duly published in the Proceedings of this Society for 1883, page 200.

The result of the effort to obtain copies of the Standard will be given in detail by the custodian, Prof. Geo. E. Fell, whose report is hereto appended.

ALBERT MCCALLA,
LESTER CURTIS,
GEORGE E. FELL,
Committee.

REPORT OF PROFESSOR FELL.

To the American Society of Microscopists:

On page 263 of the Proceedings of this Society for 1883, will be found the resolution appointing the committee named above.

On page 200 of the same proceedings will be found, in addition to the rules for the control of the Standard, two resolutions relating to the method of "obtaining copies of the same." The first reads as follows:

"Resolved, That Professor W. A. Rogers be requested to prepare three verified copies of the Standard on glass."

In accordance with this resolution, at the earliest opportunity following the completion of the Proceedings of the Chicago meeting, I communicated with Professor Rogers relative to his action in the matter. In answer to my communication I received, December 10th, 1883, a letter from him suggesting that some other person should make the copies, as it would not be desirable that the one who made the comparisons with the original, should test his own work. In the same letter Professor Rogers named Mr. Charles Fasoldt of Albany, N. Y., as one capable of making the copies, and

suggested that Dr. R. H. Ward, the Secretary of the National Committee on Micrometry who resides, in Troy, N. Y. would probably transact all immediate business with Mr. Fasoldt relating to the procuring of the copies.

On presenting to the committee the views of Professor Rogers, I was formally authorized to forward the Standard to Dr. Ward, who signified by a later communication his willingness to transact the necessary business with Mr. Fasoldt.

However, before the Standard had been forwarded to Dr. Ward, I received from him a communication stating that F. A. P. Barnard, President of the American Metrological Society, desired to exhibit the Standard Micrometer (obtained mainly through his influence) at the annual meeting of that Society, to be held the last week in December, 1883, in New York city. In order to have the Standard forwarded in time for the meeting, I requested and obtained by telegraph the authority to place the Standard in the hands of Professor Barnard. I requested him to forward it to Dr. Ward at his earliest convenience, and on the 28th of January, 1884, a communication announcing its receipt was received from the latter gentleman.

The instructions relative to the disposition of the Standard were made known to Dr. Ward in a letter dated January 14th, 1884, which read as follows:

"The Standard Micrometer, 'Centimeter Scale A, 1882,' is now in the hands of Professor F. A. P. Barnard of Columbia College. He has been requested to forward it to you at his earliest convenience. Please be kind enough to notify me when you receive it.

"I have been authorized by the committee in control of the Standard to have you engage Mr. Charles Fasoldt of Albany, N. Y., to prepare three accurate copies of the same on glass. The copies so obtained to be numbered respectively, 2 A, 1884, 3 A, 1884, and 4 A, 1884.

"When you procure them please forward them with the Standard to Professor W. A. Rogers of Cambridge, Mass., who will make the comparisons."

At this time Mr. Fasoldt considered that two weeks would suffice to prepare the copies. He was mistaken, as subsequent facts developed. The question arose as to the detail of the copies which is explained by the following letter of Dr. Ward dated February 2d, 1884:

"I forgot to say that the question came up in talking with Mr. Fasoldt, whether the lines of our official copies should be single lines or triplets like the plate.

Thinking it inexpedient to incur the delay of waiting to correspond with the committee on the subject, and feeling certain that the single lines would be practically better for all purposes of the copies to be used, as working micrometers, I ordered them made in that form. They will thus represent the middle lines of each set—the only ones, you will remember, that were measured by Professor Rogers.”

The suggestion of Dr. Ward was adopted, and Mr. Fasoldt authorized to make the copies correspond with the center lines of the Standard.

Some uncertainty existing as to the copies being “exact reproductions” of the Standard, considerable correspondence passed between Dr. Ward, Professor Rogers and myself relative thereto.

The views of Professor Rogers as embodied in a letter to my address, dated March 18th, 1884, were as follows: he “opposed any copy of ‘A’ which was not an exact reproduction, errors and all”; that he had sent a letter to President Barnard as a permanent expression of his views on the subject. (I have not succeeded in obtaining a copy of this letter for publication.) He also informed me that if he was to compare the copies before the Rochester meeting, he “would require them before long.”

March 22d, 1884, Dr. Ward wrote me that he had not yet received the copies from Mr. Fasoldt. May 26th, in a communication to Professor Rogers, I asked him if he could prepare copies of the Standard before the Rochester meeting, and make the comparisons subsequently. He stated in a letter of June 5th, that “if it should be ascertained that Mr. Fasoldt would not make the copies, he would try to do so, if he could receive the Standard in time.”

However, to settle the matter, and if possible expedite the preparation of the copies, I placed the subject before the committee and suggested that authority be given to send the Standard to Professor Rogers with what copies Mr. Fasoldt might have prepared, etc. This authority was granted, and I communicated with Dr. Ward, notifying him of the action of the committee. I was soon notified by Dr. Ward that he had forwarded the Standard to Professor Rogers.

Shortly after this I received a communication from Dr. Ward, together with three copies of the Standard prepared by Mr. Fasoldt, a bill for the same, and a certificate from Mr. S. G. Shanks as to the accuracy of the rulings, which are here given:

BILL OF MR. FASOLDT.

ALBANY, N. Y., July 8th, 1884.

THE AMERICAN SOCIETY OF MICROSCOPISTS,

TO CHAS. FASOLDT, DR.

To time consumed in comparing and remeasuring the Standard Centimeter,	\$20.00
“ Three Standard Centimeters, @ \$8.00 each,	24.00
“ Three boxes, @ 30c each,90
Total,	<u>\$44.90</u>

CERTIFICATE OF MR. SHANKS.

ALBANY, N. Y., June 29, 1884.

MR. CHAS. FASOLDT,

Dear Sir: I have compared three plates of the Standard Centimeters ruled by you and I find them entirely uniform in spacing. S. G. SHANKS.

It will be noticed in this certificate that it does not state that the copies are “exact copies” (within micrometric limits) of the Standard, and deeming that Mr. Fasoldt should present such a certificate to the Society if he felt so justified, I wrote him to that effect.

August 7th, 1884, I received the following letter:

LUZERNE, N. Y., Aug. 5th, 1884.

DR. GEO. E. FELL, Buffalo, N. Y.:

Dear Sir: This is to certify that the three copies of the Standard Centimeter Micrometer are exact in length and uniformity of the spacing in the same.

Yours very truly,

C. FASOLDT.

Subsequently, Mr. Fasoldt wrote me the following letter, which indicates that he considered the copies as accurate as it was possible to make them.

ALBANY, N. Y., Aug. 23, 1884.

DR. GEO. E. FELL:

Dear Sir: Your letter of the 18th inst. was duly received with draft for \$44.90, for which I herewith return receipted bill, supposing it to be sufficient certificate, but if you will kindly write out an appropriate certificate and send it to me I will copy and sign it.

Yours truly,

C. FASOLDT.

Per F. E. P.

July 16th, I received a communication acknowledging the receipt of the copies by Professor Rogers and suggesting the propriety of having the comparisons made also by some one beside himself. Acting in accordance with this suggestion I assumed some authority, as the time before the meeting at Rochester was limited, and

wrote a letter to Professor Rogers, requesting him to place the copies with the Standard in the hands of Professor W. A. Anthony, of Cornell University, Ithaca, N. Y., who kindly offered to make a series of comparisons. This action was subsequently approved by the committee.

The comparisons of Professors Rogers and Anthony which are given below, were received barely in time for presentation at the Rochester meeting, the report of Professor Rogers being placed in my hands by him at Rochester, while that of Prof. Anthony was mailed to my address at Buffalo and received at Rochester the last day of the meeting. I make no comments on the results of these comparisons, further than to call attention to the remarkably small average deviation (0.10μ) noted in the comparisons of results of Prof. Rogers with those of Prof. Anthony. It is proposed to print an additional number of these reports for the benefit of those who may have occasion to use the Fasoldt Scale F in Micrometry.

REPORT OF PROFESSOR W. A. ROGERS.

Comparison of Fasoldt Scale F, with Standard Centimeter Scale "A."

With 1-inch Objective.

Date.	T. °	1 div. = $.503\mu$ ("A"—F) In divisions of micrometer.
July 12	20.90	—8.6
13	21.13	—6.5
13	21.15	—8.6
14	18.65	—9.1
14	18.65	—9.1
14	17.73	—7.2
15	16.15	—8.6
15	16.00	—9.0
15	16.78	—8.6
21	18.50	—8.2
22	18.62	—8.2
		Mean.
		—8.34
		= 1.20μ

With $\frac{1}{2}$ -inch Objective.

1 div. = 0.20μ

July 27	19.10	—18.3
28	19.30	—20.1
29	19.50	—19.4
30	20.10	—19.1
		—19.22
		= 3.81μ

By combination giving a weight of 3 to the first and of 1 to the second series we find $F - 4.1\mu = "A."$

F is therefore 4.1μ too long when compared with "A."

Relative Errors of Separate Millimeters.

With 1-inch Objective.

Corrections counting from the end having the $\frac{1}{100}$ mm. band.

Spaces.	I.	II.	III.	IV.	Mean.
1	—2.3 div.	—3.0 div.	—3.2 div.	—2.2 div.	—2.7 div.
2	+0.2	+1.1	+1.0	—0.8	+0.4
3	+0.0	—1.0	—0.8	+0.8	—0.2
4	+1.9	+1.7	+1.8	+1.9	+1.8
5	—1.3	+0.0	+0.9	+1.2	+0.2
6	—2.2	+0.8	+1.0	+0.0	—0.1
7	—2.1	—1.6	—1.8	+0.0	—1.4
8	+1.0	+0.0	—0.6	—2.3	—0.5
9	+1.6	—0.5	+0.6	—2.8	—0.3
10	+3.0	+2.4	+1.0	+4.2	+2.7

With $\frac{1}{2}$ -inch Objective.

Spaces.	I.	II.	III.	IV.	Mean.
1	—5.4 div.	—7.8 div.	—7.8 div.	—7.1 div.	—7.0 div.
2	+2.3	+0.4	+0.2	2.3	+1.3
3	+1.2	+1.9	+1.5	+1.1	+1.4
4	+4.7	+5.1	+5.7	+5.7	+5.3
5	+1.6	+0.6	+0.7	+0.4	+0.8
6	—4.6	—3.3	—0.5	—3.6	—3.0
7	—1.3	—0.7	—1.5	—2.3	—1.5
8	—4.2	—1.7	—3.9	—2.8	—3.2
9	—1.2	—2.7	—0.7	—0.9	—1.4
10	+7.0	+8.2	+6.4	+7.1	+7.2

Combining the results from each series, giving equal weights, we have the following series of corrections to be applied to the measured spaces.

Corrections counting from the $\frac{1}{100}$ mm. band.

Spaces.	With 1-in. obj.	With $\frac{1}{2}$ -in. obj.	Mean.	Summed Series.
1	-1.4μ	-0.4μ	-1.4μ	-1.4μ
2	+0.2	+0.3	+0.3	-1.1
3	-0.1	+0.3	+0.1	-1.0
4	+0.9	+1.1	+1.0	+0.0
5	+0.1	+0.2	+0.1	+0.1
6	-0.1	-0.6	-0.3	-0.2
7	-0.7	-0.3	-0.5	-0.7
8	-0.3	-0.6	-0.5	-1.2
9	-0.2	-0.3	-0.2	-1.4
10	+1.4	+1.5	+1.4	+0.0

The $\frac{1}{100}$ mm. band is, therefore, relatively 1.4μ too long, or absolutely 1.8μ too long.

W. A. ROGERS.

Cambridge, Aug. 1, 1884.

REPORT OF PROFESSOR WM. A. ANTHONY.

ITHACA, N. Y., Aug. 16, 1884.

Geo. E. Fell, M. D.:

DEAR SIR—I send, to-day, the A. S. M. Centimeter, with the Fasoldt copy sent to me for comparison.

My comparisons, made at temperatures from 18.1° to 20.0° C. give as a mean of four fairly concordant sets for the Fasoldt compared with the mean millimeter of the Standard, counting from the $\frac{1}{100}$ mm. end.

Spaces.	Corrections.
1	-1.1μ
2	+0.2
3	+0.0
4	+0.7
5	-0.1
6	-0.5
7	-0.1
8	-0.3
9	-0.2
10	+1.4

A mean of ten comparisons of the whole cm. at 18.1° C. gives for the Fasoldt 4.2 μ too long.

The subdivisions of the metal cm. are not equal. The greatest error is in the end division which is 1.2 μ too long.

Very truly yours,

WM. A. ANTHONY.

COMPARISONS OF RESULTS OBTAINED BY PROFESSOR ROGERS WITH
THOSE OBTAINED BY PROFESSOR ANTHONY.

Rogers.	Anthony.	Mean.	Mean minus Rogers.	Mean minus Anthony.
—1.4 μ	—1.1 μ	—1.25 μ	+ .15 μ	—0.15
+0.3	+0.2	+0.27	— .03	+0.07
+0.1	+0.0	+0.05	— .05	+0.05
+1.0	+0.7	+0.85	— .15	+0.15
+0.1	—0.1	+0.00	— .10	+0.10
—0.3	—0.5	—0.40	— .10	+0.10
—0.5	—0.1	—0.30	+ .20	—0.20
—0.5	—0.3	—0.40	+ .10	—0.10
—0.2	—0.2	—0.20	+ .00	+0.00
+1.4	+1.4	+1.40	+ .00	+0.00

Corrections to the Whole Length.

Rogers.	Rogers.	Anthony.	Mean.
1-inch obj.	$\frac{1}{2}$ -inch obj.	—	—
—4.20 μ	—3.81 μ	—4.20	—4.07
Mean minus Rogers.		Mean minus Anthony.	
+0.03 μ		+ .13 μ	

Average deviation = 0.10 μ

In closing this report it may be of interest to state that the Standard Micrometer has been deposited in the vaults of the Buffalo Loan and Safe Deposit Company during a portion of the past year at a small charge to the Society. Mr. F. S. Pease, of Buffalo, has, within the past month, donated a place in his lock-box, in the same vault, for this purpose, free of expense to the Society, so that we are assured a perfectly secure place for its keeping.

GEO. E. FELL,

Custodian.

ROCHESTER, August 19, 1884.